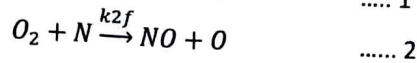
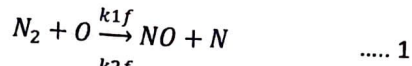


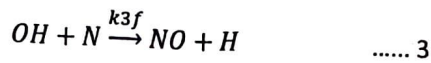
## MCL 732 Minor II, 15 Marks

### Problem 1

The Zeldovich mechanism for NO pollutant formation during combustion of any fossil fuel, as discussed in class, involves



The extended Zeldovich mechanism involves addition of another reaction



Show that the extended mechanism results in same expression for  $d[NO]/dt$  as the original Zeldovich mechanism, given that pseudo steady state approximation is valid for N. If needed, assume O is in equilibrium with  $O_2$  and that H, OH are also present in some equilibrium concentrations.

(5)

### Problem 2

Consider that a receptor site samples ten particulate matter species: A,B,C ... J for conducting  $PM_{2.5}$  source apportionment via PMF. Given is the correlation matrix created on the basis of the species time series data at the site.

	A	B	C	D	E	F	G	H	I	J
A	1	0.85	-0.11	0.68	0.04	0.78	0.92	-0.18	0.78	0.11
B	0.85	1	0.14	-0.08	-0.18	0.9	0.81	0.16	0.13	0.17
C	-0.11	0.14	1	0.05	0.92	0.11	0.12	0.88	0.02	0.78
D	0.68	-0.08	0.05	1	0.03	-0.12	0.15	-0.13	0.89	0.14
E	0.04	-0.18	0.92	0.03	1	0.07	-0.1	0.92	0.12	0.86
F	0.78	0.9	0.11	-0.12	0.07	1	0.84	-0.16	0.11	0.12
G	0.92	0.81	0.12	0.15	-0.1	0.84	1	0.14	0.13	-0.13
H	-0.18	0.16	0.88	-0.13	0.92	-0.16	0.14	1	0.08	0.8
I	0.78	0.13	0.02	0.89	0.12	0.11	0.13	0.08	1	0.12
J	0.11	0.17	0.78	0.14	0.86	0.12	-0.13	0.8	0.12	1

It is known that three major  $PM_{2.5}$  sources prevail in the sampled region. Provide the list of constituent species present in each factor that the PMF analysis is expected to yield by simply observing the correlation matrix. You are not required to provide the percentage composition of the factors, just the species present in each.

(4)

### Problem 3

- A. Can Govt. monitoring station data, such as provided by Central Pollution Control Board (CPCB) sites in Delhi, be used for a) PM<sub>2.5</sub> source apportionment, or b) aggregate air pollutant source apportionment? Provide brief reasoning. (2)
- B. The tropospheric NO, NO<sub>2</sub> and O<sub>3</sub> cycle covered in class involving three basic reactions fails to predict the high urban Ozone concentrations, especially such as those observed in the photochemical smog events in 1950s-70s in US. Briefly reason why. (2)
- C. Preliminary PMF run on some ambient data assuming  $n$  factors results in minimal correlation between the various factor time series. Should we increase, decrease, or keep same the number of assumed factors in the next run? Briefly explain. (2)

add  
all the  
pollutants  
together.